

PERIPHERAL UNIVERSAL BUS HUB

Field

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The present invention relates generally to communications protocols, and more specifically to a communications protocol hub integrated with an input device.

Background

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It has become more and more common to have a computer based home entertainment system, integrating a computer with other home entertainment products, such as a VCR, audio devices, computer peripherals, and the like. Integrated personal computer and television systems are known in the art as a
15 "convergence environment" in which a personal computer (PC) is integrated with other capabilities, such as and usually including at least television (TV) capability. Such hardware components are known and available within the art. For example, the Gateway Destination PC/TV system, available from Gateway 2000, Inc., provides a convergence environment across two primary modes of operation: TV viewing, and
20 PC operation (i.e., such that the system provides TV and PC capability). Such a system is available from Gateway 2000, Inc., and is known as the Gateway Destination system.

Peripheral computer devices attached to a computer may include, for example and not by way of limitation, a mouse or other pointing device, printers, scanners,
25 modems, keyboards, joysticks and game pads, and virtual reality devices such as gloves and visors. These devices are typically physically connected to the computer CPU box via cables and the like. As such, mobility and range of the devices is somewhat limited. Although longer cables may be attached to the devices, for each device attached, a cord is used.

30 Some peripheral devices such as keyboards, mice, joysticks, and the like have recently been equipped with wireless communication links to the main computer.



Such wireless links include radio frequency (RF) links and infrared links. Other links may be viable, such as optical and the like. However, due to the movement nature of many such peripherals, such as a mouse, joysticks, game pads, and the like, a wireless link may be difficult to maintain since movement may interrupt the

5 wireless link, especially in the case of an infrared link.

Wireless peripherals such as keyboards, joysticks, and the like allow the peripheral to be moved further away from the main computer, without the interference of a number of cords or cables leading to the main computer. However, other devices which are not commonly available as wireless devices, such as a
10 mouse, printer, scanner, and the like, are still often desired or even required to be near the keyboard. Long cords for connection of such devices clutter the area, and pose potential problems with respect to safety and convenience.

Relatively recently, a consortium of computer vendors proposed a new type of bus structure to replace the existing serial peripheral bus. The Universal Serial
15 Bus (USB) open-architecture standard specifies USB devices known as "hubs" that provide attachment points for other USB devices, such as USB-compliant peripherals (called "functions") or additional hubs. Self-powered hubs and functions contain independent power supplies to power themselves, and self-powered hubs can also power any other devices attached to them. A "root" hub embedded in the computer
20 routes data between the USB peripherals and the appropriate processing logic in the computer. The standard also defines USB software that works with current power management software to enable the suspending and resuming of devices attached to the USB in response to the state of the computer. The combination of the computer, the standard operating system, the root hub, and the USB software is called a USB
25 "host."

Each hub has multiple attachment points, known as "ports," to which its functions and other hubs are connected by means of USB-specific cables. Functions are generally standard computer peripherals which conform to the USB standard, or specialized circuitry designed to add certain functionality to the computer. Functions
30 can be hardware, firmware, software, or a combination. A single USB port can be

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used to connect up to 127 peripheral devices of all types. These devices may be referred to as functions. The USB supports high speed data transfers of 12 million bits per second (Mbps), which allows USB to support telephony, audio and compressed video data streams.

5 It also establishes a universal cable connector which can provide power at various levels to peripherals attached to the bus. In addition, the USB standard defines a common logical interface for all types of peripherals that simplifies the design of supporting USB software and enables easy configuration of a system. USB
10 Thus allows for so-called plug and play connection outside the computer case, reducing the need for the use of internal dedicated computer slots and controller cards, and also reducing the need for reconfiguration of the computer system each time a peripheral is added or changed. USB allows "on-the-fly" reconfiguration of a system as soon as a peripheral is plugged into a USB connector. No rebooting or setup of the system is necessary.

15 USB hubs have been placed outside the computer box before. For example, USB hubs have been placed in speakers attached to a computer system, and are commonly attached to computer monitors. The reason for these attachments is that the USB hub requires power, either self contained, or from an active power source. Monitors and speakers for computer systems are typically independently powered,
20 providing the power for a USB hub. Speakers and monitors are also typically connected directly to the computer CPU box, and are positioned near it.

 It would be desirable to provide increased functionality of peripheral devices away from the main computer unit. It would further be desirable to provide communication links for peripheral devices.

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Summary

The present invention overcomes the problems of the prior art by providing an input device with an integrated communications protocol hub and peripheral
5 device connectors on the input device. Input devices such as keyboards, remote cursor control devices, and the like, are examples of input devices which are the subject of the present invention.

The peripheral with integrated communications protocol hub may communicate with a host computer via a wireless link. The communications
10 protocol hub integrated with the input device allows the connection of peripherals directly to the input device, without the restriction that they be connected directly to the main computer unit. This allows freedom for the input device and necessary peripherals to be used with a system such as the Gateway Destination system discussed above.

15 In another embodiment, a computer system has a main unit, and an input device in which a communications protocol hub is integrated. The input device is in communication with the main unit via a wireless link. Additional peripherals, such as a mouse or other pointing device, a scanner, a printer, joysticks, game pads, or the like are connected to the communications protocol hub integrated within the input
20 device, and are not tethered to the main computer unit. Such peripherals may be in communication with the input device via wired or wireless links. Standard peripherals may be used. They do not need to be specially modified to connect to the input device.

In the above embodiments, only a single link to the main unit from the input
25 device is required. The link is wireless in one embodiment. The present invention eliminates the need for a number of cords or wireless links to be made to the main computer unit, and frees the user to move peripherals away from the main computer unit without the problems of having cord attachments to the main unit, or the expense of having multiple wireless links from peripherals to the main computer
30 unit.

A method embodiment of the present invention comprises connecting peripheral devices of a computer system to a single input device, the input device having an integrated universal serial bus hub, and connecting or linking the peripherals of the computer system to a main computer unit wirelessly through the
5 input device communications protocol hub.

Brief Description of the Drawings

Figure 1 is a block diagram view of an embodiment of the present invention;
10 Figure 2 is a perspective view of a keyboard embodiment of the present invention;
Figure 3 is a perspective view of a remote cursor control embodiment of the present invention;
Figure 4 is a flow chart diagram of a method embodiment of the present
15 invention;
Figure 5 is a block diagram view of another embodiment of the present invention; and
Figure 6 is a view of a computer system on which embodiments of the present invention may be practiced.

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Description of Embodiments

In the following detailed description of sample embodiments, reference is made to the accompanying drawings which form a part hereof, and in which are
25 shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and logical, structural, electrical, and other changes may be made without departing from the scope of the present invention.

In Figure 1, an apparatus embodiment 10 of the present invention is shown in conjunction with a main computer unit 12 having a display 14 and a central processing unit 16. Embodiment 10 has an input device 18 integrated with a communications protocol hub 20 having peripheral device connectors such as slots or ports 22. Communications protocol hub 20 communicates with a plurality of connected peripheral devices through one or more of a number of communications protocols. The communication between the hub 20 and any connected devices may be wireless or wired, depending upon the peripheral device. Communications protocol hub 20 is preferably integrated with input device 18, but may be implemented in a separate component which is physically connected to the input device 18. Connector slots or ports 22 allow the connection to the input device 18 of a plurality of peripheral devices 24, such as mouse 26, joystick 28, and scanner 30.

In one embodiment, the hub 20 is a universal serial bus (USB) hub. A USB hub offers the ability to connect a large number of USB peripherals to the hub 20 without requiring a large amount of real estate for connector slots. It should be understood that any variety or combination of communications protocols could be used with the hub 20 without departing from the scope of the invention. Such protocols include, by way of example and not limitation, to serial and parallel ports, IEEE-48, RS-232, Centronics parallel, gameport I/F, and the like.

Input device 18 is in communication with main computer unit 12 via a communication link 34. Communication link 34 is a wireless link, such as an infrared or radio frequency link, in one embodiment. If communication link 34 is a wireless link, the input device 18 must have a separate power supply to provide power to communications protocol hub 20, as well as to any attached peripheral devices 24. In one embodiment, power is provided to the input device 18 and its communications protocol hub 20 by an internal battery source 36, which may be disposable or rechargeable batteries. Such power sources are known in the art, and will not be described further herein. Alternatively, power may be provided to input device 18 and communications protocol hub 20 by a connection 38 to an active

power source such as a standard wall electrical outlet or the like. Such a connection is also known in the art and will not be described further herein.

If the communications protocol hub is a USB hub, the power requirements and specifications for USB hubs and devices are enumerated in Chapter 7 of the
5 Universal Serial Bus Specification, Revision 1.1, dated September 23, 1998. It is to be understood that such specifications often change with time, and that it is sufficient that the power provided to USB hub 20 meets the USB specification. Modification of the power supplied to the communications protocol hub 20 is well within the scope of one of ordinary skill in the art.

10 Peripheral devices 24 may be connected to input device 18 communications protocol hub 20 connectors 22 via standard cables 32, or may be connected to input device 18 communications protocol hub 20 via a wireless link. As has been mentioned, a single USB hub can support up to 127 such devices 24.

Figure 2 shows a keyboard embodiment 40 of an input device in accordance
15 with the present invention. Keyboard 40 includes an integrated communications protocol hub 42 and a plurality of peripheral device connector slots 44. Connector slots 44 facilitate the connection of peripheral devices such as joystick 46 and mouse 48 to keyboard 40 with standard USB connector plugs 50 and cabling 52. The connector slots 44 may be USB, serial or parallel, IEEE-48, RS-232, Centronics
20 parallel, gameport I/F, and the like.

Alternatively, peripheral devices may communicate with keyboard 40 via a wireless communication link. For example, joystick 54 is shown as having a wireless communication link 56 to keyboard 40. Signals from wireless joystick 54 are received by transceiver 58 on keyboard 40. Because of the usual close proximity
25 of a wireless joystick 54 to keyboard 40, the wireless link 56 may be a weak link.

Keyboard 40 may communicate with a host computer such as computer 12 via a wireless link. Various types of wireless links to a host may be used. For example, a radio frequency antenna 60 is shown as part of keyboard 40. Radio frequency signals from keyboard 40 are communicated to a host computer such as
30 computer 12 via the wireless link. Data and operation information for the input



device and any attached peripheral devices are also transmitted along the wireless link. In this manner, the peripheral communications protocol hub allows connection of peripherals directly to the keyboard, which may be located remotely to the host computer. Alternatively, the wireless connection to a host computer may be via an
5 infrared link, or other wireless links known in the art.

Connection of peripheral devices such as joysticks 46 and 54, and mouse 48 to keyboard 40 allows a single wireless link to be made between all the devices and the host computer. The communications protocol hub 42 integrated with keyboard 40 coordinates the signals from the attached peripherals. The wireless connection
10 between keyboard 40 and a host computer transmits all information from the keyboard and the communications protocol hub 42 to the host computer. The single link between the keyboard 40 and a host computer eliminates some of the potential clutter of numerous peripheral cords running to a main computer.

Wireless joysticks, game pads, and the like may be connected to the
15 communications protocol hub 42 of keyboard 40. In this manner, the previously tenuous link between a wireless device which by its very nature moves around, and a host computer is strengthened by the link to a main computer being from the keyboard 40. For example, the keyboard 40 may have an infrared link to the host computer. When peripheral devices such as joysticks, game pads, a mouse, and the
20 like, are connected to the keyboard 40, the keyboard 40 may be positioned so as to properly effect the link. Since the keyboard is usually a fairly stationary device, the link, be it infrared or RF, will tend to be more stable. The problems of maintaining a direct link between a moving wireless peripheral and the main computer are reduced.

Keyboard 40 may be powered by a connection to an active power supply,
25 such as a standard home electrical outlet. Keyboard 40 may also be provided with an internal power supply such as batteries, as has been described above.

Figure 3 shows a remote cursor control embodiment 70 of the invention. Remote cursor control 70 may have an alphanumeric keypad 72, and a pointing device such as touch pad 74 for cursor control functionality. Further, remote cursor
30 control 70 has an integrated communications protocol hub 76 and a plurality of

peripheral device connector slots 78. As with keyboard embodiment 40, peripheral devices such as mouse 80 and joystick 82 are connectable to the connector slots 78 of remote cursor control 70 via connectors 84 and cable 86. Alternatively, as in keyboard 40, a wireless device may be connected to remote cursor control 70.

5 Remote cursor control 70 may be powered by a connection to an active power supply, such as a standard home electrical outlet. Remote cursor control 70 may also be provided with an internal power supply such as batteries, as has been described above.

Figure 4 is a flow chart diagram of a method 90 embodying the present invention. Method 90 comprises connecting one or more peripherals, such as joysticks, game pads, a mouse, and the like, to a single input device having an integrated universal serial bus hub in block 92. The operation and command structure operation of the peripherals attached to the communications protocol hub are controlled by the hub. In one embodiment, the communications protocol hub is
10 linked to a main host computer through the wireless connection of the input device to the host computer in block 94. Examples of wireless links include but are not limited to infrared and radio frequency links.
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In a USB communications protocol hub, the signal contains USB packets for the connected peripheral devices. USB packets from the USB hub within the input
20 device are placed in the signal stream sent to the host computer in block 96, and a single signal is sent to the host computer along a single communication link in block 98.

In another alternative embodiment 100 shown in Figure 5, a remote wireless controller 102 has a plurality of connector slots 104 to which a plurality of peripheral
25 devices 106 are connected using standard connectors 108 and cable 110. Connectors 108 may be serial or parallel connectors, USB connectors, or the like, as described above. A second remote wireless controller 112 also has a plurality of connector slots 114 to which a plurality of peripheral devices 116 are connected using standard connectors 118 and cable 120. Connectors 118 may be serial or parallel connectors,
30 USB connectors, or the like.

A third wireless controller 122 is located close to a main host computer 124. Wireless controller 122 receives information from and transmits information to wireless controllers 102 and 112. As shown, wireless controller 122 has RF transceiver device 126 and infrared transceiver device 128. Transceiver 126 communicates in wireless fashion with RF antenna 130 of wireless controller 102, and transceiver 128 communicates in wireless fashion with infrared transceiver 132 of wireless controller 112. The wireless controllers 102 and 112 allow the connection of standard peripherals using their own connection structures, such as parallel or serial interfaces. The wireless controllers 102 and 112 receive information destined for the peripheral devices attached to them, and reformat the signals into a format usable by the specific peripheral.

The third wireless controller 122 is connected to main host computer 124 via a communications protocol connection 134. The remote wireless controllers communicate with attached peripherals through a variety of protocols, and the base controller 122 communicates with the main host computer via a communications protocol connection.

Personal computers such as computer 140 shown in Figure 6 typically include a monitor 150, keyboard input 152, central processing unit 154, and a pointing or selection device such as mouse 155. Further components of a typical computer system may include a machine readable storage media such as disk drive 156, hard disk, CD-ROM 158, DVD, modem, and the like. The processor unit of such a computer typically includes a microprocessor, memory (RAM and ROM), and other peripheral circuitry, not shown. Computer system 140 may further comprises elements of a multimedia convergence system 100. Embodiments of the present invention may be included in, or developed in conjunction with, a software architecture of a computerized convergence system as disclosed in co-pending U.S. Patent Application S/N 09/002828 entitled "Architecture for Convergence Systems," which is incorporated in its entirety by reference herein.

Method 90 in one embodiment may comprise computer programs written to perform the methods on a personal computer 140 as shown in Figure 6. The

computer programs run on the central processing unit 154 out of main memory, and may be transferred to main memory from permanent storage via disk drive 156 when stored on removable media or via a network connection or modem connection when stored outside of the personal computer, or via other types of computer or machine readable medium from which it can be read and utilized. The computer programs comprise multiple modules or objects to perform the method 90. The type of computer programming languages used to write the code may vary between procedural code type languages to object oriented languages. The files or objects need not have a one to one correspondence to the modules or method steps described depending on the desires of the programmer. Further, the method and apparatus may comprise combinations of software, hardware and firmware as is well known to those skilled in the art.

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement which is calculated to achieve the same purpose may be substituted for the specific embodiments shown. This application is intended to cover any adaptations or variations of the invention. It is intended that this invention be limited only by the following claims, and the full scope of equivalents thereof.

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